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Design Criteria for the 200-ZP-1 Interim Remedial Measure

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Bechtel Hanford, Inc.
Richland, Washington

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ACRONYMS

ASME	American Society of Mechanical Engineers
ANSI	American National Standards Institute
BHI	Bechtel Hanford, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
DQO	data quality objectives
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
FM	Factory Mutual
GAC	granular activated carbon
IRM	interim remedial measure
IROD	interim record of decision
MCL	Maximum Contaminant Limit
NEC	National Electric Code
NEPA	National Environmental Policy Act
RCRA	Resource Conservation and Recovery Act
RL	Richland Operations Office
T-BACT	Best Available Control Technology for Toxins
UL	Underwriters Laboratories
VAC	volts alternating current
WAC	Washington Administrative Code
WDOH	Washington State Department of Health

1.0 INTRODUCTION

The *Interim Remedial Measure Proposed Plan for the 200-ZP-1 Operable Unit* (DOE-RL 1994a) recommended a pump and treat action to contain contaminated groundwater and limit further degradation of groundwater due to elevated concentrations of carbon tetrachloride, chloroform, and trichloroethylene in the 200-ZP-1 Operable Unit. Carbon tetrachloride, chloroform, and trichloroethylene are organic contaminants which present high potential risk because of their carcinogenic characteristics. They have been detected in the groundwater at concentrations that significantly exceeded drinking water standards; however, the contaminated groundwater is not currently used as a drinking water source.

This design criteria document defines the Project. The Project encompasses:

- Site preparation
- Development of groundwater wells for monitoring, extraction, and injection
- Extraction and injection equipment
- Construction of a treatment system with support buildings/utilities
- Management
- Engineering design, analysis, and reporting
- Operation and maintenance.

A groundwater pump and treat system, hereafter the System, will be composed of extraction wells, a piping network, treatment equipment, water storage, and injection wells.

Based upon engineering judgement, the selected technology in the proposed plan (DOE-RL 1994a) is air stripping of the organic contaminants followed by vapor-phase adsorption onto granulated activated carbon (GAC); liquid-phase GAC may be required as a polishing step. These technologies were chosen because they are existing and proven technologies for the treatment of volatile organic contamination in water, and they are known to be highly effective for removing and treating volatile-organic contaminants. The Treatment Equipment refers to air stripping towers, adsorption vessels, water pumps, air blowers, instrumentation, and control devices which will be procured as a turn-key system.

1.1 BACKGROUND

The report *Engineering Evaluation/Conceptual Plan for the 200-ZP-1 Operable Unit Interim Remedial Measure* (BHI 1994) provides information regarding the need and potentially achievable objectives and goals for an interim remedial measure (IRM). The report describes the following:

- The technical basis in creating a hydraulic containment zone
- A conceptualization of the well field
- A description of flow and regulatory criteria the treatment system would have to meet
- An evaluation of the vadose and aquifer capture zones
- Criteria for technical evaluation of pump and treat system performance
- Activities in addition to pump and treat.

The *Treatability Test Plan for the 200-ZP-1 Operable Unit* (DOE-RL 1994b) provides a plan for pilot-scale pump and treat testing which is presently operating using aqueous-phase GAC. To develop this design criteria document, the plan was reviewed for relevant criteria. The plan does not place requirements on this Project. Relevant criteria from the plan were data quality objectives (DQOs) for treatment testing (see Appendix A). The DQOs were developed specifically for the treatability testing and should be used by the IRM for guidance in determining the operating parameters.

1.2 SCOPE

This document delineates the criteria for the design, procurement, and construction for the Project. The scope of this document does not evaluate well design, construction, and development. General criteria are provided for operations and maintenance, safety, and environmental compliance.

1.2.1 Project Objectives

The objective of this IRM is to contain the plume and thereby limit further degradation of groundwater. Based on this objective, "A successful pump and treat IRM would result in:

1. Containing the highly contaminated portion of the plume
2. Extracting a significant mass of the contaminants
3. Reducing a source of available contaminants that contributes to ongoing groundwater contamination
4. Reducing concentration of contaminants in the groundwater." (DOE-RL 1994a).

1.2.2 Schedule Objectives

The dates around which the project schedule is created are as follows:

Description	Date
Phase One. A pilot-scale treatability test has begun and is scheduled to run 6 months. The test evaluates the effectiveness of the technology, liquid-phase granular activated carbon adsorption of organic contaminants.	8/29/94
Submit Design Criteria document to the U.S. Department of Energy (DOE).	12/31/94
Phase Two. Complete construction/acceptance testing and initiate startup operation of the System. The System will be capable of operating at 150 gpm.	9/30/95

Description	Date
Complete startup operational testing.	1/31/96
Submit letter report to DOE that evaluates the effectiveness and operational efficiency of the System. Recommend whether to expand to phase three and to what groundwater extraction rate.	5/96
Phase Three, Step 1. The System may be expanded to operate up to 300 gpm with additional wells based upon the evaluation of the Phase Two System.	FY 1996
Phase Three, Step 2. The System may be expanded to operate up to 500 gpm with additional wells.	FY 1997

The contract to procure a turn-key system of treatment equipment is to be awarded in April 1995.

The contract to construct the System is to be awarded in June 1995.

Performance reports for the System will be submitted on a monthly basis until the end of IRM operation.

1.2.3 Cost Objectives

The IRM is funded by the DOE-Richland Operations Office (RL) Environmental Restoration Program and managed by Bechtel Hanford, Inc. (BHI). The estimated costs for the Project are stated in the *Interim Remedial Measure Proposed Plan for the 200-ZP-1 Operable Unit* (DOE-RL 1994a). Since a conceptual design and estimate have not been prepared, the budgeted costs are subject to refinement.

1.3 SITE LOCATION

The 200 West Area boundary is shown in Figure 1-1, "200 West Carbon Tetrachloride Map. The location of the treatment system has yet to be identified.

A conceptual sketch of the "Location of the Extraction and Injection Wells for the Interim Remedial Measure" is shown in Figure 1-2.

Figure 1-1. 200 West Carbon Tetrachloride Groundwater Plume Map.

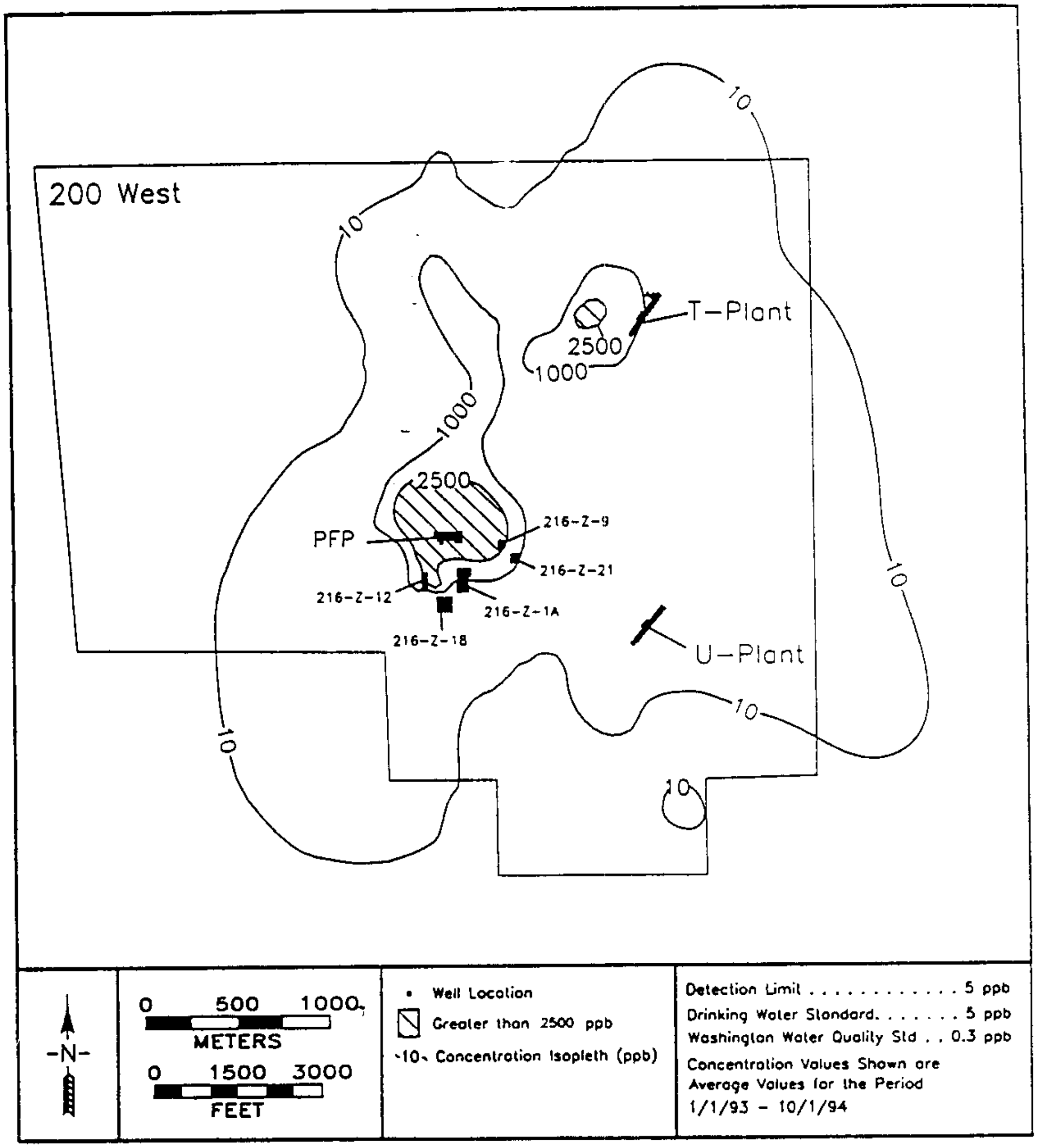

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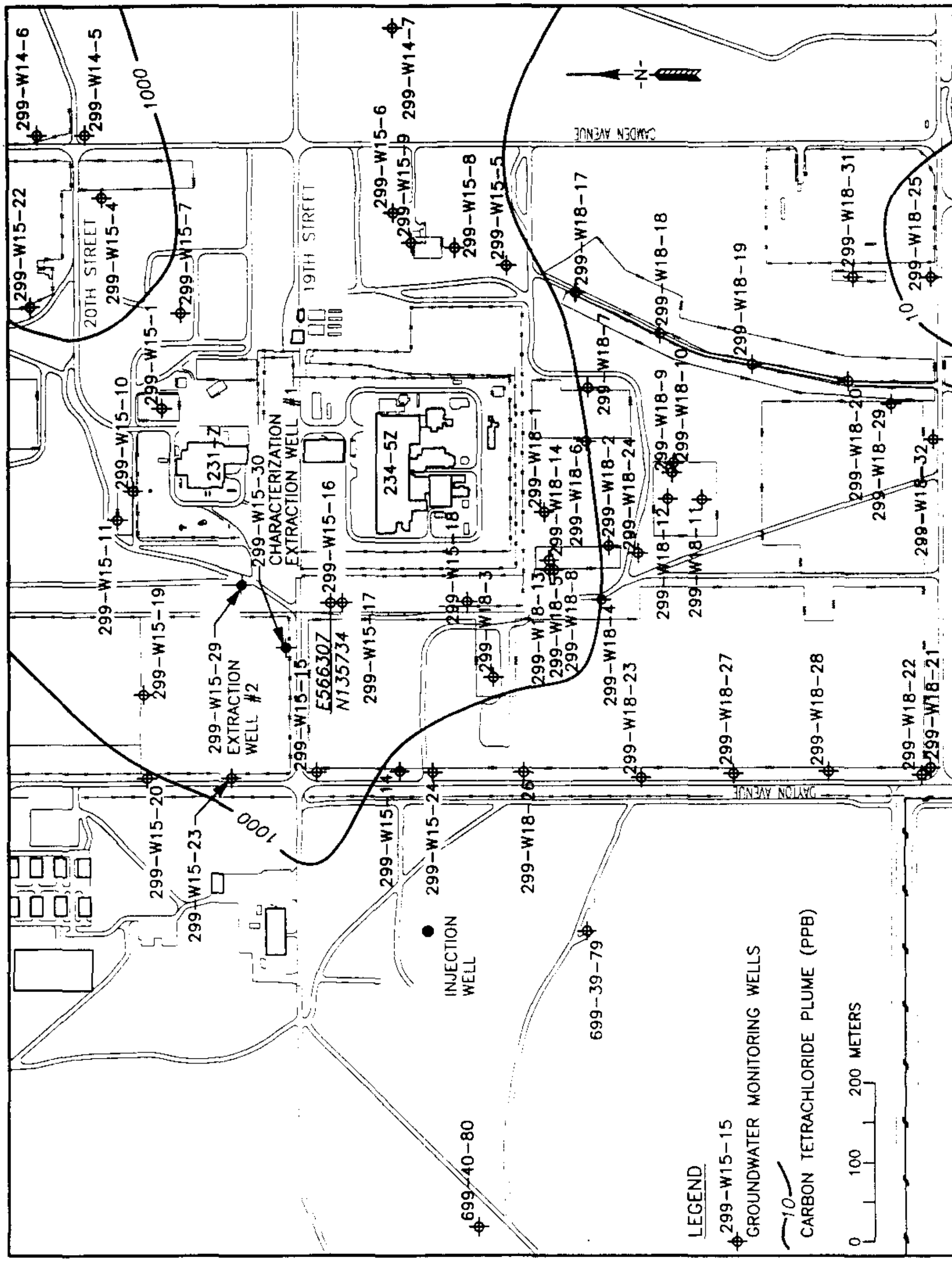
Figure 1-2. Location of the Extraction and Injection Wells for the Interim Remedial Measure.



1.4 JUSTIFICATION

The IRM System will be required by the IRM Proposed Plan which has just finished the public comment period. If the Proposed Plan is accepted, the interim record of decision (IROD) will also require the System.

The IRM System will accelerate cleanup of the 200-ZP-1 Operable Unit groundwater, providing a reduction in potential risk to human health and the environment by removal of contaminant mass and limiting contaminant spread at the area of greatest contamination.

2.0 PROJECT CRITERIA

2.1 MINIMUM PROJECT REQUIREMENTS

The Project shall provide a System for removal of the contaminants.

The Project shall meet the schedule and cost objectives.

The Project shall use commercially available equipment, based upon proven technology.

The Project shall provide facilities/utilities (e.g., buildings or tents) to protect/support the System and operations, as needed.

The Project shall provide water and air monitoring and sampling consistent with environmental regulations.

The Project shall provide facilities and equipment to prepare and temporarily store the dangerous wastes for disposal (e.g., spent GAC).

The Project shall be designed to withstand Hanford weather conditions. Climatological data (average temperatures, wind roses, etc.) are provided in *Climatological Data Summary, 1993* (PNL 1993).

Drawings and specifications issued for construction shall have the stamp of a registered professional engineer, licensed in the state of Washington.

The Project shall be designed in the units of the *American Engineering System*, and soft metric units noted beside.

2.2 PERFORMANCE REQUIREMENTS

The System shall extract and treat groundwater at the flow rates necessary to contain the highly contaminated portion of the plume.[1]

The System shall have a design downtime of no more than 20% (i.e., the ratio of the time equipment is not operating to total time).

The System shall operate 24 hours per day, 7 days per week.

The System shall be designed to remove water contaminants such that the effluent concentrations of carbon tetrachloride, chloroform, and trichloroethylene are below their respective maximum contaminant limit (MCL).

The System shall remove air contaminants to meet air emission standards (see Section 4.2).

2.3 OPERATIONAL REQUIREMENTS

The design life of the System is 10 years. The estimated time to contain and reduce the concentrated portion of the CCl_4 plume is 2 to 40 years depending upon geochemical adsorption properties (BHI 1994).

2.4 FUTURE EXPANSION CONSIDERATIONS

As noted in the Schedule Objectives, the project will include phased expansion. The initial design shall consider the planned expansion and present economically justified additions and/or enlargements of equipment. The concept of modular design should be considered. The design shall incorporate features that require minimal design changes later on.

3.0 DESIGN CRITERIA

3.1 ARCHITECTURAL/CIVIL/STRUCTURAL

The design shall include:

- An evaluation for interferences to the location of the treatment equipment, the pipe runs, and access roads
- Grading of access route(s)/road(s), treatment site(s), and parking area(s)
- A material laydown area and locked storage space

[1] In the future, there may be a trade-off. Increasing the groundwater flow rate above the design point will increase the effluent contaminant concentration (decrease the amount removed).

- Office space for at least two personnel, a lunch room, a personnel change area, and sanitation facilities (portable facilities are preferred; avoid buildings with foundations which must be removed at the end of the project)
- Two or more telephone lines
- Raw water or groundwater for chemical make-up and other operations
- Potable water for personnel use
- Waste disposal for dangerous waste, industrial waste, and sanitary waste
- The capability to operate in the winter (the need for a facility, e.g., pre-fabricated structure or tent, to contain the equipment shall be determined)
- Electrical power from the Hanford Site power network.

NOTE: It is not required that raw water, potable water, and sewage be connected (piped) into Hanford Utilities.

3.2 PROCESS

3.2.1 Flow Rates and Water Characterization

Flow Rates

In Phase Two, the System shall be operating at 150 gpm with three extraction wells (two new and one existing) and one injection well (BHI 1994). The System shall be designed with at least 33% excess capacity.

In Phase Three, step one, the System may be expanded to operate up to 300 gpm with six extraction wells and three injection wells (BHI 1994).[1]

In Phase Three, step two, the System may be expanded to operate up to 500 gpm with 10 extraction wells and five injection wells (BHI 1994).

Water Characterization

The influent water characteristics for the design basis are as follows:

- Groundwater temperature: 61°F (16.1°C)
- pH: Ranges from 7 to 9. Average pH = 7.9
- SpG: 1.0

[1] The number of extraction and injection wells is conceptual and the actual number will be based upon data collected from Phase Two operation and using the data in a hydrology model.

- Turbidity: 2.0
- Contaminant concentrations in water are presented in Table 3-1.
- See Table 3-2 for select constituents in the groundwater.

Table 3-1. Contaminant Concentrations and Limits.

	Carbon Tetrachloride (BHI 1994)	Chloroform (BHI 1994)	Trichloroethylene (BHI 1994)
Maximum Concentration	7,000 μg/L (ppb) *	1,600 μg/L **	25 μg/L
Detection Limit	5 μg/L +/- 10%	5 μg/L	5 μg/L
Drinking Water Standard	5 μg/L	100 μg/L Total trihalomethanes	5 μg/L

* Carbon tetrachloride samples in the ZP Area (see Table 3-2) range up to 7,000 μg/L, with the peak reading at Well 299-W15-16. The average for 9 samples at this well was 4,545.6 μg/L.

** Chloroform samples in the ZP-1 Area (see Table 3-2) generally range up to 170 μg/L. One other well sample was at 1,600 μg/L.

Table 3-2. Select Constituents in the Groundwater (HEIS 1994).

Well	Constituent	Units	Min. Date	Max. Date	Min. Result	Max. Result	Avg. Result	# of samples	# of Nondetects
299-W15-10	Carbon tetrachloride	ppb	4/6/93	4/7/94	2188.0	2357.0	2257.5	2	0
299-W15-15	Carbon tetrachloride	ppb	3/13/92	5/27/94	860.0	1400.0	1264.6	7	0
299-W15-16	Carbon tetrachloride	ppb	3/17/92	7/1/94	10.0	7000.0	4545.6	9	1
299-W15-17	Carbon tetrachloride	ppb	3/17/92	5/27/94	0.4	4.0	1.9	6	4
299-W15-19	Carbon tetrachloride	ppb	1/20/92	5/27/94	350.0	1600.0	896.7	8	0
299-W15-23	Carbon tetrachloride	ppb	2/12/92	5/27/94	150.0	690.0	428.6	7	0
299-W15-10	Chloroform	ppb	4/6/93	4/7/94	10.0	12.0	11.0	2	0
299-W15-15	Chloroform	ppb	3/13/92	5/27/94	0.4	8.7	5.3	7	4
299-W15-16	Chloroform	ppb	3/17/92	7/1/94	0.4	35.0	18.9	9	4
299-W15-17	Chloroform	ppb	3/17/92	5/27/94	0.2	5.0	1.8	6	4
299-W15-19	Chloroform	ppb	1/20/92	5/27/94	38.0	170.0	98.4	8	0
299-W15-23	Chloroform	ppb	2/12/92	5/27/94	1.3	5.3	3.4	7	3
299-W15-10	Trichloroethylene	ppb	4/6/93	4/7/94	2.9	3.2	3.1	2	0
299-W15-15	Trichloroethylene	ppb	3/13/92	5/27/94	0.5	5.0	2.5	7	6
299-W15-16	Trichloroethylene	ppb	3/17/92	7/1/94	0.8	10.0	5.1	9	5
299-W15-17	Trichloroethylene	ppb	3/17/92	5/27/94	0.0	5.0	2.7	6	6
299-W15-19	Trichloroethylene	ppb	1/20/92	5/27/94	0.8	5.0	2.8	7	5
299-W15-23	Trichloroethylene	ppb	2/12/92	5/27/94	0.1	5.0	2.7	7	6
299-W15-10	pH	pH	4/6/93	4/7/94	7.6	7.9	7.8	2	0
299-W15-15	pH	pH	3/13/92	11/10/94	7.5	8.2	7.8	15	0
299-W15-16	pH	pH	3/17/92	11/8/94	7.5	7.9	7.7	19	0
299-W15-17	pH	pH	3/17/92	11/9/94	7.7	8.3	8.0	20	0
299-W15-19	pH	pH	1/20/92	5/27/94	7.9	8.5	8.2	20	0
299-W15-23	pH	pH	2/12/92	5/27/94	6.9	17.0	8.9	18	0
299-W15-15	Turbidity	NTU	3/13/92	11/10/94	0.3	6.6	1.9	6	0
299-W15-16	Turbidity	NTU	3/17/92	11/8/94	0.3	2.5	1.3	6	0
299-W15-17	Turbidity	NTU	3/17/92	11/9/94	0.4	2.2	1.2	6	0
299-W15-19	Turbidity	NTU	1/20/92	12/3/93	0.8	7.0	3.6	6	0
299-W15-23	Turbidity	NTU	2/12/92	11/19/93	0.3	2.3	0.9	5	0

3.2.2 Unit Operations

The System shall provide a piping network to bring the groundwater from the extraction wells to the treatment equipment. The well pumps shall accommodate flow rates ranging from 50 to 100 gpm from each well and accommodate depths from 150 ft to 400 ft.

The System shall:

- Mix the influent groundwater from different wells to provide a more uniform contaminant concentration to be treated
- Pretreat influent groundwater to inhibit bacterial growth in the air stripper columns
- Filter the influent groundwater before treatment and provide redundant filters
- Filter the treated water before injection and provide redundant filters
- Provide a piping network to return the treated water from the treatment equipment to the injection wells and provide redundant pumps.

The treatment equipment shall be designed to handle the following conditions:

- Maximum inlet water CCl_4 concentration of 5,000 ppb[1]
- Water flow rate turndown capability of 25%
- A minimum process temperature of 7°C (45°F)
- Relative humidity in the air stream entering the GAC vessels (controlled for optimal adsorptive efficiency).

Provide means to inhibit the deposition of hard water scale (such as acid injection) or provide means to clean the scale from the air stripper columns.

The design shall, at a minimum, define the following parameters for the air stripping equipment:

- Operating pressure
- Differential pressure
- Final concentration of organic (ppb)
- Volumetric air/water ratio
- Turndown for the air flow rate
- Water recycle flow rate.

---

[1] The maximum CCl_4 concentration of 7,000 ppb was measured in one monitoring well; however, the average concentration from that well is less than 5,000 ppb. The choice of 5,000 ppb CCl_4 versus 7,000 ppb is probably more accurate and will prevent an over design of the treatment equipment. Also, the mixing of water from multiple wells and the use of recycled effluent water to dilute high concentrations can ensure the efficient use of equipment.

Provide redundant GAC vessels so that replacement of GAC will not halt operations.

Provide means to handle a GAC vessel loading/unloading for offsite regeneration.

Provide means for material handling and waste disposal.

The design shall also consider:

- A storage tank system for off-specification water (i.e., treated water which does not meet operational criteria for injection).
- Minimizing the aboveground storage of groundwater and using the aquifer as the natural storage.
- Having onsite spare air stripper packing and tankage to clean the used packing.

3.2.3 Cost Benefit Analyses

Prepare a cost benefit analysis to evaluate differences in capacity when procuring treatment equipment. Modules (skids) of the treatment equipment may be located together or separately.

Prepare a cost benefit analysis to evaluate how the volumetric air/water ratio in the air stripper affects the costs of the air stripper columns and the GAC vessels.

Prepare a cost benefit analysis to evaluate the procurement of an air heater to decrease the relative humidity to increase the efficiency of CCl_4 adsorption onto GAC.

Prepare a cost benefit analysis to evaluate whether the piping system should be aboveground or buried.

Prepare a cost benefit analysis to evaluate GAC waste disposal options such as offsite regeneration, burial, or onsite regeneration.

3.2.4 Sampling Points

The design shall provide:

- Manual sampling for each extraction well
- Manual sampling after mixing of water from extraction wells
- Automated sampling for treated water
- Automated sampling for air before and after each GAC vessel.

3.3 INSTRUMENTATION AND CONTROL

3.3.1 General

Instrumentation shall be provided to clearly indicate, control, and alarm the conditions and parameters of the pump and treat system by a process control system from a central control panel.

The process control system shall be based on a programmable logic controller. It shall:

- Provide continuous monitoring and interval recording of process inputs and control outputs
- Ensure stability
- Ensure safe and efficient operation of the System
- Allow for unattended operation with an automatic telephone dialer to notify personnel of problems.

Design life for the process control system shall be 10 years with normal maintenance and operation.

Any software provided as part of the process control system which is stored in volatile memory shall not be copy protected. This is to allow backup copies to be generated for protection against loss of the primary copy.

All electrical elements provided as part of the process control system shall be Underwriters Laboratories (UL) or Factory Mutual (FM) listed and used/installed per National Electric Code (NEC) requirements.

All wiring between field devices and the process control system field termination panels, interconnecting wire and cable between system components shall be provided and be clearly and permanently labeled. Labeling shall correspond to the drawings to be furnished. Instrumentation, including transmitters, shall be individually labeled per Instrument Society of America Standards.

Acceptance testing shall be documented.

Consider "smart" type process instrumentation to allow for remote troubleshooting and calibration.

3.3.2 Instrument Sensing Points

As a minimum, the following shall be measured and recorded:

- Water flow rates, extraction and injection
- Emission air flow rates
- Water levels in the extraction, injection, and monitoring wells
- Water levels in any storage tanks
- An indicating parameter or the CCl_4 concentration in the effluent water stream
- An indicating parameter or the CCl_4 concentration in the emission air stream

- An indicating parameter or the chloroform and trichloroethylene concentrations
- Humidity in the stripper air stream entering the vapor-phase GAC.

Monitoring well instrumentation may be time-shared, for e.g., a monitoring well may be continuously monitored every other month.

3.3.3 Automated Process Control Points

The well pump systems and the treatment equipment shall operate in an automatic control mode with start-stop interlocks. Consider redundant shutdown interlocks. Process equipment shall have local and remote control switches, with the remote located at a central control panel.

For tank storage, overflow protection and back-flow prevention shall be automated.

Process vessel pressure relief shall be automated and included if required.

An automatic telephone dialer system shall notify offsite personnel of basic malfunctions of the System.

The operator, when present, will procedurally take action before the interlocks activate, e.g., panel alarm lights will activate before interlock shutdown switches.

The monitoring of water levels in wells shall be separate from the process control instrumentation.

3.3.4 Instrument/Electrical Documentation

Engineering drawings, process flow diagrams, piping and instrumentation diagrams, and wiring diagrams illustrating the process control system shall be provided. Wiring diagrams shall show all numbered cables, wiring, and wiring terminations, and shall delineate panel termination points.

A complete list shall be provided of spare parts with all part numbers, quantities, and material descriptions.

A set of preventive maintenance requirements shall be generated during the design process.

Installation instructions and technical manuals will be prepared which describe the following:

- Hardware
- Hardware maintenance, servicing, and calibration procedures
- Software program
- Configuration including graphics, text, and database editors
- Operations manuals outlining installation and use of the process control system.

3.4 MECHANICAL

Piping and equipment materials shall be compatible for the intended service and designed in accordance with American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) B31.3, "Chemical Plant and Petroleum Refinery Piping," or ANSI/ASME B31.9, "Building Services Piping."

Freeze protection shall be provided to those systems and components where necessary.

Provide means to drain the piping systems or provide pressurized air blowing of the lines.

Multiple mechanical requirements are specified in Section 4.2, "Requirements Based Upon Environmental Regulations," because secondary containment of the piping and tank systems shall be provided.

3.5 ELECTRICAL

Electrical power shall serve the System, such as pumps, air blowers, air heaters, freeze protection heat tracing on piping and equipment, lighting, and instrumentation and control. Line power shall be transformed to 480 volts alternating current (VAC) three phase electrical service for the System, and to 110/220 VAC single phase service for the office and associated computer equipment.

Adequate lighting shall be provided to support continuous operations. Lighting shall illuminate the exterior work areas.

All electrical work shall meet NEC requirements.

Acceptance testing shall be documented.

3.6 HYDROLOGY

The hydrological design is already under way. Refer to the *Engineering Evaluation/Conceptual Plan for the 200-ZP-1 Operable Unit Interim Remedial Measure* (BHI 1994) for discussion of the hydrological design.

4.0 GENERAL REQUIREMENTS

4.1 SAFETY AND HEALTH REQUIREMENTS

To address safety and health issues, related to either the design or the construction of this project, a Pre-Task Safety Assessment and ALARA review shall be prepared. If warranted, a Pre-Task Action Plan shall be prepared.

4.2 REQUIREMENTS BASED UPON ENVIRONMENTAL REGULATIONS

The 200-ZP-1 Pump and Treat System will treat a Resource Conservation and Recovery Act (RCRA) hazardous waste; therefore, substantive RCRA standards will apply to design and operation. Standards for tank systems are given by the Dangerous Waste Regulations, Washington Administrative Code (WAC) 173-303, authorized by the RCRA. A copy of WAC 173-303-640, "Tank Systems," is provided in Appendix B.

The following substantive RCRA standards shall be met as applicable to design:

- WAC 173-303-640 (3) Design and installation of new tank systems or components
- WAC 173-303-640 (4) Containment and detection of releases
- WAC 173-303-640 (5) General operating requirements.

The applicable air-emission regulations are as follows:

- WAC 173-400 General Regulations for Air Pollution Sources
- WAC 173-400-113 Requirements for new sources in attainment or unclassifiable areas
- WAC 173-460 Controls for New Sources of Toxic Air Pollutants.

The air-emission standards are to be determined by an analysis, i.e., a Best Available Control Technology for Toxins (T-BACT) analysis. As design proceeds, engineering shall present options to DOE for negotiation with the EPA, Ecology, and the Washington Department of Health (WDOH).

4.3 ADMINISTRATIVE AND OPERATIONAL DOCUMENTATION

The following documentation/notifications are required prior to initiation of construction:

- Pre-Task Safety Analysis
- National Environmental Policy Act (NEPA) Documentation
- Excavation permits (if excavation required)
- Hanford Site Planning Notification.

The following documentation/notifications are required prior to initiation of the operations:

- Site Specific Health and Safety Plan
- Environmental Protection and Compliance Review
- Operations/maintenance procedures
- Sampling Plan/Quality Assurance Project Plan
- Readiness Evaluation/Conduct of Operations Checklist
- Department of Health Notification of Potential Emissions
- Fire Department/Emergency response personnel notification
- Waste Control Plan.

5.0 CODES AND STANDARDS

At a minimum, the design shall consider the following codes and standards.

- DOE General Design Criteria (DOE Order 6430.1A)
- ASME Boiler and Pressure Vessel Code
- American Society for Testing Materials
- NEC
- American Welding Society General Standards
- American Society of Heating, Air Conditioning, and Refrigeration Engineers Guide and Data Book
- FM Handbook of Industrial Loss Prevention.

6.0 REFERENCES

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APPENDIX A

DATA QUALITY OBJECTIVES FOR THE 200-ZP-1 OPERABLE UNIT IRM PLUME GAC ADSORPTION TREATMENT TESTING

Table 3-1. Data Quality Objectives for 200-ZP-1 Operable Unit IRM Plume GAC Adsorption Treatment Testing. (Sheet 1 of 3)

Activity Pilot-scale Treatability Test

Objectives Assess effectiveness, operating parameters, and costs of using GAC adsorption to remove carbon tetrachloride, chloroform, and TCE from extracted groundwater.

Prioritized Data Uses

Priority data uses are to support the selection of a preferred treatment technology for use with pump and treat at the IRM plume.

Appropriate Analytical Level or Implementation Guidelines

Level I and II screening analyses will be used for process monitoring. As a minimum, carbon tetrachloride, chloroform, TCE, and nitrate concentrations will be verified by limited Level III analyses. No validation (Level IV) data will be required since only interim action decisions are being supported. These requirements are detailed in the Process SAP (Appendix B) and the Quality Assurance Project Plan (QAPjP)(Appendix D).

Parameters to be Obtained

Effectiveness:
- Influent and effluent concentrations of carbon tetrachloride, chloroform, TCE, and nitrate

Operating Parameters:
- Process chemistry (e.g., total suspended solids, dissolved oxygen, TOC, sodium, chloride, sulfate, heavy metals, VOCs)
- Flow rate
- pH, temperature, turbidity, oxidation/reduction potential
- Operating pressures, both differential and point
- Chemical additive requirements

Resource Needs:
- Equipment/materials
- Personnel and maintenance requirements
- Secondary waste volumes and characteristics
- Power and chemical usages
- Onstream factors
- Health and safety requirements, including field radiation monitoring
- Other cost elements (e.g., mobilization, sample transport, analytical services, decontamination, residuals transport/treatment/disposal.

Table 3-1. Data Quality Objectives for 200-ZP-1 Operable Unit IRM Plume GAC Adsorption Treatment Testing. (Sheet 2 of 3)

Required Detection or Measurement Limits

- Effectiveness

Analytical detection limits for carbon tetrachloride, chloroform, TCE, and nitrate must be able to detect expected effluent concentrations after 90% removal. Accuracy should be sufficient to support calculation of removal efficiency to ±5%. Other supporting documentation such as equipment data sheets may also affect final DQOs. Detection limits and other PARCC parameters are specified in the QAPjP (Appendix D). The following are DQOs for Level III analyses:

Parameter	Method	CRDL/CRQL[a]	Precision	Accuracy
Carbon tetrachloride	[b]	10 µg/L	±20%	75-125%
Chloroform	[b]	10 µg/L	±20%	75-125%
TCE	[b]	10 µg/L	±20%	75-125%
Nitrate	EPA 300, 352.1, 353.3, 353.2, 354.1	100µg/L	±20%	75-125%

- Operating Parameters

Process chemistry will be measured primarily to detect significant and/or unanticipated secondary impacts on system operation and efficiency. Analytical protocols will follow established vendor standards, industrial standards, or EPA practices. Other operating parameters will be measured as follows:

Parameter	Instrument	Range	Accuracy
Flow rate	meter	10-100 gal/min	±1 gal/min
pH	probe	0-14	±0.1
Oxidation/reduction potential	probe	100-1,400 mV	±5 mV
Temperature	thermocouple or thermometer	0-100 °C	±1 °C
Turbidity	meter	0-100 NTU[c]	±5 NTU
Differential Pressure	transducer or gauge	0-30 lb/in^2	±0.5 lb/in^2
Point pressure	transducer or gauge	0-100 lb/in^2	±1 lb/in^2

Table 3-1. Data Quality Objectives for 200-ZP-1 Operable Unit IRM Plume GAC Adsorption Treatment Testing. (Sheet 3 of 3)

- <u>Resource Needs</u>

Resources will be monitored in accordance with normal recordkeeping practices (e.g., inventory, manhours) specific to each resource type. The EPA guidance calls for an accuracy of +50% to -30% in estimating implementation costs.

Critical Samples or Values

- Carbon tetrachloride, chloroform, and TCE concentrations in influent and effluent streams at a frequency proportional to the rate of change in the primary contaminants
- Chemical and radiological concentrations in spent GAC and discarded filter cartridges
- Operating costs (e.g., materials, personnel)
- Secondary waste disposal costs.

Constraints

- It is necessary that GAC breakthrough be measured in a timely manner for carbon tetrachloride, chloroform, and TCE.
- Representative samples are required of process water streams, discarded filter cartridges, and spent GAC.
- Groundwater monitoring is required to verify that the pumped water is representative of site conditions.
- Some GAC and filter cartridge samples may have high radionuclide content and may require special sampling and handling methods.

a/ CRDL = contract required detection limit
CRQL = contract required quantitation limit

b/ As specified in the Contract Laboratory Requirement's Statements of Work for inorganic analysis; all analytical methods, contract required detection limits, contract required quantitation limits, and precision and accuracy requirements shall be as specified therein without modification per the QAPjP (Appendix D).

c/ NTU = nephelometric turbidity unit(s).

APPENDIX B

COPY OF WAC-173-303-640, TANK SYSTEMS

WAC 173-303-640 Tank systems.

(1) Applicability.

(a) The regulations in WAC 173-303-640 apply to owners and operators of facilities that use tank systems to treat or store dangerous waste, except as (b) and (c) of this subsection provides otherwise.

(b) Tank systems that are used to store or treat dangerous waste which contain no free liquids and are situated inside a building with an impermeable floor are exempted from the requirements in subsection (4) of this section. To demonstrate the absence or presence of free liquids in the stored/treated waste, the test method described in WAC 173-303-110 (3)(c)(i) must be used.

(c) Tank systems, including sumps, as defined in WAC 173-303-040, that serve as part of a secondary containment system to collect or contain releases of dangerous wastes are exempted from the requirements in subsection (4)(a) of this section.

(2) Assessment of existing tank system's integrity.

(a) For each existing tank system, the owner or operator must determine that the tank system is not leaking or is unfit for use. Except as provided in (b) of this subsection, the owner or operator must obtain and keep on file at the facility a written assessment reviewed and certified by an independent, qualified registered professional engineer, in accordance with WAC 173-303-810 (13)(a), that attests to the tank system's integrity by January 12, 1988, for underground tanks that do not meet the requirements of subsection (4) of this section and that cannot be entered for inspection, or by January 12, 1990, for all other tank systems.

(b) Tank systems that store or treat materials that become dangerous wastes subsequent to January 12, 1989, must conduct this assessment within twelve months after the date that the waste becomes a dangerous waste.

(c) This assessment must determine that the tank system is adequately designed and has sufficient structural strength and compatibility with the waste(s) to be stored or treated, to ensure that it will not collapse, rupture, or fail. At a minimum, this assessment must consider the following:

(i) Design standard(s), if available, according to which the tank system was constructed;

(ii) Dangerous characteristics of the waste(s) that have been and will be handled;

(iii) Existing corrosion protection measures;

(iv) Documented age of the tank system, if available (otherwise, an estimate of the age); and

(v) Results of a leak test, internal inspection, or other tank system integrity examination such that:

(A) For nonenterable underground tanks, the assessment must include a leak test that is capable of taking into account the effects of temperature variations, tank end deflection, vapor pockets, and high water table effects; and

(B) For other than nonenterable underground tanks and for ancillary equipment, this assessment must include either a leak test, as described above, or other integrity examination, that is certified by an independent, qualified, registered professional engineer, in accordance with WAC 173-303-810 (13)(a), that addresses cracks, leaks, corrosion, and erosion.

[Note: The practices described in the American Petroleum Institute (API) Publication, Guide for Inspection of Refinery Equipment, Chapter XIII, "Atmospheric and Low-Pressure Storage Tanks," 4th edition, 1981, may be used, where applicable, as guidelines in conducting other than a leak test.]

(d) If, as a result of the assessment conducted in accordance with (a) of this subsection, a tank system is found to be leaking or unfit for use, the owner or operator must comply with the requirements of subsection (7) of this section.

(e) The owner or operator must develop a schedule for conducting integrity assessments over the life of the tank to ensure that the tank retains its structural integrity and will not collapse, rupture, or fail. The schedule must be based on the results of past integrity assessments, age of the tank system, materials of construction, characteristics of the waste, and any other relevant factors.

(3) Design and installation of new tank systems or components.

(a) Owners or operators of new tank systems or components must obtain (and for facilities that are pursuing or have obtained a final status permit, submit to the department, at time of submittal of Part B information) a written assessment, reviewed and certified by an independent, qualified registered professional engineer, in accordance with WAC 173-303-810 (13)(a), attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of dangerous waste. The assessment must show that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste(s) to be stored or treated, and corrosion protection to ensure that it will not collapse, rupture, or fail. This assessment (which will be used by the department to review and approve or disapprove the acceptability of the tank system design at facilities which are pursuing or have obtained a final status permit) must include, at a minimum, the following information:

(i) Design standard(s) according to which tank system(s) are constructed;

(ii) Dangerous characteristics of the waste(s) to be handled;

(iii) For new tank systems or components in which the external shell of a metal tank or any external metal component of the tank system will be in contact with the soil or with water, a determination by a corrosion expert of:

(A) Factors affecting the potential for corrosion, including but not limited to:

(I) Soil moisture content;

(II) Soil pH;

(III) Soil sulfides level;

(IV) Soil resistivity;

(V) Structure to soil potential;

(VI) Influence of nearby underground metal structures (e.g., piping);

(VII) Existence of stray electric current;

(VIII) Existing corrosion-protection measures (e.g., coating, cathodic protection); and

(B) The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system during the use of the tank system or component, consisting of one or more of the following:

(I) Corrosion-resistant materials of construction such as special alloys, fiberglass reinforced plastic, etc.;

(II) Corrosion-resistant coating (such as epoxy, fiberglass, etc.,) with cathodic protection (e.g., impressed current or sacrificial anodes); and

(III) Electrical isolation devices such as insulating joints, flanges, etc.

[Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP-02-85)--Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems," and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems," may be used, where applicable, as guidelines in providing corrosion protection for tank systems.]

(iv) For underground tank system components that are likely to be adversely affected by vehicular traffic, a determination of design or operational measures that will protect the tank system against potential damage; and

(v) Design considerations to ensure that:

(A) Tank foundations will maintain the load of a full tank;

(B) Tank systems will be anchored to prevent flotation or dislodgment where the tank system is either placed in a saturated zone, or is located less than five hundred feet from a fault which has had displacement in Holocene times, and

(C) Tank systems will withstand the effects of frost heave.

(b) The owner or operator must develop a schedule for conducting integrity assessments over the life of the tank to ensure that the tank retains its structural integrity and will not collapse, rupture or fail. The schedule must be based on the results of past integrity assessments, age of the tank system, materials of construction, characteristics of the waste, and any other relevant factors.

(c) The owner or operator of a new tank system must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation. Prior to covering, enclosing, or placing a new tank system or component in use, an independent, qualified installation inspector or an independent, qualified, registered professional engineer, either of whom is trained and experienced in the proper installation of tank systems or components, must inspect the system for the presence of any of the following items:

(i) Weld breaks;

(ii) Punctures;

(iii) Scrapes of protective coatings;

(iv) Cracks;

(v) Corrosion;

(vi) Other structural damage or inadequate construction/ installation.

All discrepancies must be remedied before the tank system is covered, enclosed, or placed in use.

(d) New tank systems or components that are placed underground and that are backfilled must be provided with a backfill material that is a noncorrosive, porous, homogeneous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported.

(e) All new tanks and ancillary equipment must be tested for tightness prior to being covered, enclosed, or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the tank system being covered, enclosed, or placed into use.

(f) Ancillary equipment must be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

[Note: The piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), "Installation of Underground Petroleum Storage Systems," or ANSI Standard B31.3, "Petroleum Refinery Piping," and ANSI Standard B31.4 "Liquid Petroleum Transportation Piping System," may be used, where applicable, as guidelines for proper installation of piping systems.]

(g) The owner or operator must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided under (a)(iii) of this subsection, or other corrosion protection if the department believes other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation.

(h) The owner or operator must obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system and supervise the installation of the tank system in accordance with the requirements of (b) through (g) of this subsection, that attest that the tank system was properly designed and installed and that repairs, pursuant to (c) and (e) of this subsection, were performed. These written statements must also include the certification statement as required in WAC 173-303-810(13)(a).

(4) Containment and detection of releases.

(a) In order to prevent the release of dangerous waste or dangerous constituents to the environment, secondary containment that meets the requirements of this subsection must be provided (except as provided in (f) and (g) of this subsection):

(i) For all new tank systems or components, prior to their being put into service;

(ii) For all existing tank systems used to store or treat Dangerous Waste Nos. F020, F021, F022, F023, F026, and F027, within two years after January 12, 1989;

(iii) For those existing tank systems of known and documented age, within two years after January 12, 1989, or when the tank system has reached fifteen years of age, whichever comes later;

(iv) For those existing tank systems for which the age cannot be documented, within eight years of January 12, 1989; but if the age of the facility is greater than seven years, secondary containment must be provided by the time the facility reaches fifteen years of age, or within two years of January 12, 1989, whichever comes later; and

(v) For tank systems that store or treat materials that become dangerous wastes subsequent to January 12, 1989, within the time intervals required in (a)(i) through (iv) of this subsection, except that the date that a material becomes a dangerous waste must be used in place of January 12, 1989.

(b) Secondary containment systems must be:

(i) Designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, ground water, or surface water at any time during the use of the tank system; and

(ii) Capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

(c) To meet the requirements of (b) of this subsection, secondary containment systems must be at a minimum:

(i) Constructed of or lined with materials that are compatible with the waste(s) to be placed in the tank system and must have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operations (including stresses from nearby vehicular traffic);

(ii) Placed on a foundation or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift;

(iii) Provided with a leak-detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within twenty-four hours, or at the earliest practicable time if the owner or operator can demonstrate to the department that existing detection technologies or site conditions will not allow detection of a release within twenty-four hours; and

(iv) Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within twenty-four hours, or in as timely a manner as is possible to prevent harm to human health and the environment, if the owner or operator can demonstrate to the department that removal of the released waste or accumulated precipitation cannot be accomplished within twenty-four hours.

(d) Secondary containment for tanks must include one or more of the following devices:

(i) A liner (external to the tank);

(ii) A vault;

(iii) A double-walled tank; or

(iv) An equivalent device as approved by the department.

(e) In addition to the requirements of (b), (c), and (d) of this subsection, secondary containment systems must satisfy the following requirements:

(i) External liner systems must be:

(A) Designed or operated to contain one hundred percent of the capacity of the largest tank within its boundary;

(B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a twenty-five-year, twenty-four-hour rainfall event.

(C) Free of cracks or gaps; and

(D) Designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).

(ii) Vault systems must be:

(A) Designed or operated to contain one hundred percent of the capacity of the largest tank within its boundary;

(B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a twenty-five-year, twenty-four-hour rainfall event;

(C) Constructed with chemical-resistant water stops in place at all joints (if any);

(D) Provided with an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of waste into the concrete;

(E) Provided with a means to protect against the formation of and ignition of vapors within the vault, if the waste being stored or treated:

(I) Meets the definition of ignitable waste under WAC 173-303-090(5); or

(II) Meets the definition of reactive waste under WAC 173-303-090(7), and may form an ignitable or explosive vapor.

(F) Provided with an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.

(iii) Double-walled tanks must be:

(A) Designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) so that any release from the inner tank is contained by the outer shell;

(B) Protected, if constructed of metal, from both corrosion of the primary tank interior and of the external surface of the outer shell; and

(C) Provided with a built-in continuous leak detection system capable of detecting a release within twenty-four hours, or at the earliest practicable time, if the owner or operator can demonstrate to the department, and the department concludes, that the existing detection technology or site conditions would not allow detection of a release within twenty-four hours.

[Note: The provisions outlined in the Steel Tank Institute's (STI) "Standard for Dual Wall Underground Steel Storage Tanks" may be used as guidelines for aspects of the design of underground steel double-walled tanks.]

(f) Ancillary equipment must be provided with secondary containment (e.g., trench, jacketing, double-walled piping) that meets the requirements of (b) and (c) of this subsection except for:

(i) Aboveground piping (exclusive of flanges, joints, valves, and other connections) that are visually inspected for leaks on a daily basis;

(ii) Welded flanges, welded joints, and welded connections, that are visually inspected for leaks on a daily basis;

(iii) Sealless or magnetic coupling pumps and sealless valves, that are visually inspected for leaks on a daily basis; and

(iv) Pressurized aboveground piping systems with automatic shut-off devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shut-off devices) that are visually inspected for leaks on a daily basis.

(g) The owner or operator may obtain a variance from the requirements of this subsection if the department finds, as a result of a demonstration by the owner or operator that alternative design and operating practices, together with location characteristics, will prevent the migration of any dangerous waste or dangerous constituents into the ground water, or surface water at least as effectively as secondary containment during the active life of the tank system or that in the event of a release that does migrate to ground water or surface water, no substantial present or potential hazard will be posed to human health or the environment. New underground tank systems may not, per a demonstration in accordance with (g)(ii) of this subsection, be exempted from the secondary containment requirements of this section.

(i) In deciding whether to grant a variance based on a demonstration of equivalent protection of ground water and surface water, the department will consider:

(A) The nature and quantity of the wastes;

(B) The proposed alternate design and operation;

(C) The hydrogeologic setting of the facility, including the thickness of soils present between the tank system and ground water; and

(D) All other factors that would influence the quality and mobility of the dangerous constituents and the potential for them to migrate to ground water or surface water.

(ii) In deciding whether to grant a variance based on a demonstration of no substantial present or potential hazard, the department will consider:

(A) The potential adverse effects on ground water, surface water, and land quality taking into account:

(I) The physical and chemical characteristics of the waste in the tank system, including its potential for migration;

(II) The hydrogeological characteristics of the facility and surrounding land;

(III) The potential for health risks caused by human exposure to waste constituents;

(IV) The potential for damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and

(V) The persistence and permanence of the potential adverse effects.

(B) The potential adverse effects of a release on ground-water quality, taking into account:

(I) The quantity and quality of ground water and the direction of ground-water flow;

(II) The proximity and withdrawal rates of ground-water users;

(III) The current and future uses of ground water in the area; and

(IV) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality.

(C) The potential adverse effects of a release on surface water quality, taking into account:

(I) The quantity and quality of ground water and the direction of ground-water flow;

(II) The patterns of rainfall in the region;

(III) The proximity of the tank system to surface waters;

(IV) The current and future uses of surface waters in the area and any water quality standards established for those surface waters; and

(V) The existing quality of surface water, including other sources of contamination and the cumulative impact on surface-water quality.

(D) The potential adverse effects of a release on the land surrounding the tank system, taking into account:

(I) The patterns of rainfall in the region; and

(II) The current and future uses of the surrounding land.

(iii) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of (g)(i) of this subsection, at which a release of dangerous waste has occurred from the primary tank system but has not migrated beyond the zone of engineering control (as established in the variance), must:

(A) Comply with the requirements of subsection (7) of this section, except subsection (7)(d) of this section; and

(B) Decontaminate or remove contaminated soil to the extent necessary to:

(I) Enable the tank system for which the variance was granted to resume operation with the capability for the detection of releases at least equivalent to the capability it had prior to the release; and

(II) Prevent the migration of dangerous waste or dangerous constituents to ground water or surface water.

(C) If contaminated soil cannot be removed or decontaminated in accordance with (g)(iii)(B) of this subsection, comply with the requirements of subsection (8) of this section.

(iv) The owner or operator of a tank system, for which a variance from secondary containment had been granted in accordance with the requirements of (g)(i) of this subsection, at which a release of dangerous waste has occurred from the primary tank system and has migrated beyond the zone of engineering control (as established in the variance), must:

(A) Comply with the requirements of subsection (7)(a), (b), (c), and (d) of this section; and

(B) Prevent the migration of dangerous waste or dangerous constituents to ground water or surface water, if possible, and decontaminate or remove contaminated soil. If contaminated soil cannot be decontaminated or removed or if ground water has been contaminated, the owner or operator must comply with the requirements of subsection (8)(b) of this section; and

(C) If repairing, replacing, or reinstalling the tank system, provide secondary containment in accordance with the requirements of (a) through (f) of this subsection or reapply for a variance from secondary containment and meet the requirements for new tank systems in subsection (3) of this section if the tank system is replaced. The owner or operator must comply with these requirements even if contaminated soil can be decontaminated or removed and ground water or surface water has not been contaminated.

(h) The following procedures must be followed in order to request a variance from secondary containment:

(i) The department must be notified in writing by the owner or operator that he intends to conduct and submit a demonstration for a variance from secondary containment as allowed in (g) of this subsection according to the following schedule:

(A) For existing tank systems, at least twenty-four months prior to the date that secondary containment must be provided in accordance with (a) of this subsection.

(B) For new tank systems, at least thirty days prior to entering into a contract for installation.

(ii) As part of the notification, the owner or operator must also submit to the department a description of the steps necessary to conduct the demonstration and a timetable for completing each of the steps. The demonstration must address each of the factors listed in (g)(i) or (ii) of this subsection;

(iii) The demonstration for a variance must be completed within one hundred eighty days after notifying the department of an intent to conduct the demonstration; and

(iv) If a variance is granted under this subsection, the department will require the permittee to construct and operate the tank system in the manner that was demonstrated to meet the requirements for the variance.

(i) All tank systems, until such time as secondary containment that meets the requirements of this section is provided, must comply with the following:

(A) For nonenterable underground tanks, a leak test that meets the requirements of subsection (2)(c)(v) of this section or other tank integrity method, as approved or required by the department, must be conducted at least annually.

(B) For other than nonenterable underground tanks, the owner or operator must either conduct a leak test as in (i)(A) of this subsection or develop a schedule and procedure for an assessment of the overall condition of the tank system by an independent, qualified registered professional engineer. The schedule and procedure must be adequate to detect obvious cracks, leaks, and corrosion or erosion that may lead to cracks and leaks. The owner or operator must remove the stored waste from the tank, if necessary, to allow the condition of all internal tank surfaces to be assessed. The frequency of these assessments must be based on the material of construction of the tank and its ancillary equipment, the age of the system, the type of corrosion or erosion protection used, the rate of corrosion or erosion observed during the previous inspection, and the characteristics of the waste being stored or treated.

(C) For ancillary equipment, a leak test or other integrity assessment as approved by the department must be conducted at least annually.

[Note: The practices described in the American Petroleum Institute (API) Publication Guide for Inspection of Refinery Equipment, Chapter XIII, "Atmospheric and Low-Pressure Storage Tanks," 4th edition, 1981, may be used, where applicable, as guidelines for assessing the overall condition of the tank system.]

(D) The owner or operator must maintain on file at the facility a record of the results of the assessments conducted in accordance with (h)(iv)(A) through (C) of this subsection.

(E) If a tank system or component is found to be leaking or unfit for use as a result of the leak test or assessment in (h)(iv)(A) through (C) of this subsection, the owner or operator must comply with the requirements of subsection (7) of this section.

(5) General operating requirements.

(a) Dangerous wastes or treatment reagents must not be placed in a tank system if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, corrode, or otherwise fail.

(b) The owner or operator must use appropriate controls and practices to prevent spills and overflows from tank or containment systems. These include at a minimum:

(i) Spill prevention controls (e.g., check valves, dry disconnect couplings);

(ii) Overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff, or bypass to a standby tank); and

(iii) Maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.

(c) The owner or operator must comply with the requirements of subsection (7) of this section if a leak or spill occurs in the tank system.

(d) All tank systems holding dangerous waste shall be marked with labels or signs to identify the waste contained in the tank. The label or sign shall be legible at a distance of at least fifty feet, and shall bear a legend which identifies the waste in a manner which adequately warns employees, emergency response personnel, and the public of the major risk(s) associated with the waste being stored or treated in the tank system(s). (Note--If there already is a system in use that performs this function in accordance with local, state or federal regulations, then such system will be adequate.)

(e) All tank systems holding EHW which is acutely or chronically toxic by inhalation must be designed to prevent escape of vapors, fumes, or other emissions into the air.

(6) Inspections.

(a) The owner or operator must develop and follow a schedule and procedure for inspecting overfill controls.

(b) The owner or operator must inspect at least once each operating day:

(i) Aboveground portions of the tank system, if any, to detect corrosion or releases of waste;

(ii) Data gathered from monitoring any leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and

(iii) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion or signs of releases of dangerous waste (e.g., wet spots, dead vegetation).

[Note: WAC 173-303-320 requires the owner or operator to remedy any deterioration or malfunction he finds. Subsection (7) of this section requires the owner or operator to notify the department within twenty-four hours of confirming a leak. Also, 40 CFR Part 302 may require the owner or operator to notify the National Response Center of a release.]

(c) The owner or operator must inspect cathodic protection systems, if present, according to, at a minimum, the following schedule to ensure that they are functioning properly:

(i) The proper operation of the cathodic protection system must be confirmed within six months after initial installation and annually thereafter; and

(ii) All sources of impressed current must be inspected and/or tested, as appropriate, at least bimonthly (i.e., every other month).

[Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP-02-85)--Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems," and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems," may be used, where applicable, as guidelines in maintaining and inspecting cathodic protection systems.]

(d) The owner or operator must document in the operating record of the facility an inspection of those items in (a) through (c) of this subsection. The owner or operator shall keep an inspection log including at least the date and time of the inspection, the printed name and the handwritten signature of the inspector, a notation of the observations made and the date and nature of any repairs or remedial actions taken. The log must be kept at the facility for at least five years from the date of inspection.

(7) Response to leaks or spills and disposition of leaking or unfit-for-use tank systems.

A tank system or secondary containment system from which there has been a leak or spill, or which is unfit for use, must be removed from service immediately, and the owner or operator must satisfy the following requirements:

(a) Cessation of use; prevent flow or addition of wastes. The owner or operator must immediately stop the flow of dangerous waste into the tank system or secondary containment system and inspect the system to determine the cause of the release.

(b) Removal of waste from tank system or secondary containment system.

(i) If the release was from the tank system, the owner/ operator must, within twenty-four hours after detection of the leak or, if the owner/operator demonstrates that it is not possible, at the earliest practicable time, remove as much of the waste as is necessary to prevent further release of dangerous waste to the environment and to allow inspection and repair of the tank system to be performed.

(ii) If the material released was to a secondary containment system, all released materials must be removed within twenty-four hours or in as timely a manner as is possible to prevent harm to human health and the environment.

(c) Containment of visible releases to the environment. The owner/operator must immediately conduct a visual inspection of the release and, based upon that inspection:

(i) Prevent further migration of the leak or spill to soils or surface water; and

(ii) Remove, and properly dispose of, any visible contamination of the soil or surface water.

(d) Notifications, reports.

(i) Any release to the environment, except as provided in (d)(ii) of this subsection, must be reported to the department within twenty-four hours of its detection. Any release above the "reportable quantity" must also be reported to the National Response Center pursuant to 40 CFR Part 302.

(ii) A leak or spill of dangerous waste is exempted from the requirements of (d) of this subsection if it is:

(A) Less than or equal to a quantity of one pound, or the "Reportable Quantity" (RQ) established in 40 CFR Part 302, whichever is less; and

(B) Immediately contained and cleaned-up.

(iii) Within thirty days of detection of a release to the environment, a report containing the following information must be submitted to the department:

(A) Likely route of migration of the release;

(B) Characteristics of the surrounding soil (soil composition, geology, hydrogeology, climate);

(C) Results of any monitoring or sampling conducted in connection with the release (if available). If sampling or monitoring data relating to the release are not available within thirty days, these data must be submitted to the department as soon as they become available;

(D) Proximity to downgradient drinking water, surface water, and populated areas; and

(E) Description of response actions taken or planned.

(e) Provision of secondary containment, repair, or closure.

(i) Unless the owner/operator satisfies the requirements of (e)(ii) through (iv) of this subsection, the tank system must be closed in accordance with subsection (8) of this section.

(ii) If the cause of the release was a spill that has not damaged the integrity of the system, the owner/operator may return the system to service as soon as the released waste is removed and repairs, if necessary, are made.

(iii) If the cause of the release was a leak from the primary tank system into the secondary containment system, the system must be repaired prior to returning the tank system to service.

(iv) If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the owner/operator must provide the component of the system from which the leak occurred with secondary containment that satisfies the requirements of subsection (4) of this section before it can be returned to service, unless the source of the leak is an aboveground portion of a tank system that can be inspected visually. If the source is an aboveground component that can be inspected visually, the component must be repaired and may be returned to service without secondary containment as long as the requirements of (f) of this subsection are satisfied. If a component is replaced to comply with the requirements of this subitem, that component must satisfy the requirements for new tank systems or components in subsections (3) and (4) of this section. Additionally, if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection (e.g., the bottom of an inground or onground tank), the entire component must be provided with secondary containment in accordance with subsection (4) of this section prior to being returned to use.

(f) Certification of major repairs. If the owner/operator has repaired a tank system in accordance with (e) of this subsection, and the repair has been extensive (e.g., installation of an internal liner; repair of a ruptured primary containment or secondary containment vessel), the tank system must not be returned to service unless the owner/ operator has obtained a certification by an independent, qualified, registered, professional engineer in accordance with WAC 173-303-810 (13)(a) that the repaired system is capable of handling dangerous wastes without release for the intended life of the system. This certification must be submitted to the department within seven days after returning the tank system to use.

[Note: See WAC 173-303-320 for the requirements necessary to remedy a failure. Also, 40 CFR Part 302 may require the owner or operator to notify the National Response Center of certain releases.]

(8) Closure and post-closure care.

(a) At closure of a tank system, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as dangerous waste, unless WAC 173-303-070 (2)(a) applies. The closure plan, closure activities, cost estimates for closure, and financial responsibility for tank systems must meet all of the requirements specified in WAC 173-303-610 and 173-303-620.

(b) If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in (a) of this subsection, then the owner or operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (see WAC 173-303-665(6)). In addition, for the purposes of closure, post-closure, and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator must meet all of the requirements for landfills specified in WAC 173-303-610 and 173-303-620.

(c) If an owner or operator has a tank system that does not have secondary containment that meets the requirements of subsection (4)(b) through (f) of this section and is not exempt from the secondary containment requirements in accordance with subsection (4)(g) of this section, then:

(i) The closure plan for the tank system must include both a plan for complying with (a) of this subsection and a contingent plan for complying with (b) of this subsection.

(ii) A contingent post-closure plan for complying with (b) of this subsection must be prepared and submitted as part of the permit application.

(iii) The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if those costs are greater than the costs of complying with the closure plan prepared for the expected closure under (a) of this subsection.

(iv) Financial assurance must be based on the cost estimates in (c)(iii) of this subsection.

(v) For the purposes of the contingent closure and post-closure plans, such a tank system is considered to be a landfill, and the contingent plans must meet all of the closure, post-closure, and financial responsibility requirements for landfills under this chapter (WAC 173-303-610 and 173-303-620).

(9) Special requirements for ignitable or reactive wastes.

(a) Ignitable or reactive waste must not be placed in tank systems unless:

(i) The waste is treated, rendered, or mixed before or immediately after placement in the tank system so that the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under WAC 173-303-090, and 173-303-395 (1)(b) is complied with; or

(ii) The waste is stored or treated in such a way that it is protected from any material or conditions which may cause the waste to ignite or react; or

(iii) The tank system is used solely for emergencies.

(b) The owner or operator of a facility which treats or stores ignitable or reactive waste in tanks must locate the tanks in a manner equivalent to the National Fire Protection Association's buffer zone requirements for tanks, contained in Tables 2-1 through 2-6 of the NFPA-30 Flammable and Combustible Liquids Code - 1981, or as required by state and local fire codes when such codes are more stringent. The owner or operator shall also comply with the requirements of WAC 173-303-395 (1)(d).

(10) Special requirements for incompatible wastes.

(a) Incompatible wastes, or incompatible wastes and materials, must not be placed in the same tank system, unless WAC 173-303-395 (1)(b) is complied with.

(b) Dangerous waste must not be placed in a tank system that has not been decontaminated and that previously held an incompatible waste or material, unless WAC 173-303-395 (1)(b) is complied with.

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